waterspout was not observed by anyone in its immediate vicinity. This was probably fortunate for the sailors, although a closer observation of this phenomenon would have been highly interesting, as it is believed to be the first time a waterspout has been observed on this coast so far north as San Diego.

## THE WEATHER AND STORMS OF MALTA DURING OCTOBER, 1898.

By JOHN H. GROUT, JR., United States Consul at Valetta, Malta.

The month of October, 1898, will long be remembered by the residents of the Maltese Islands on account of its unusually severe storms and rainfall. The rainfall alone from the first to the middle of the month has been more than has been recorded for a like period for a great many years. At the time of the beginning of the usual fall rains, moisture was badly needed by the growing crops. The amount that has this year fallen has been so extensive in quantity as to very seriously injure the crops and add to the prevailing hard times. The soil of Malta is very light in depth, and the overabundance of rain which has recently fallen has proved a disaster instead of a blessing.

On October 1, in the forenoon, a cyclone swept the islands. With it came a great quantity of rain and the result was that everything was flooded. To this was added much destruction by the exceedingly high gale. The storm lasted about three hours.

On October 19, these islands were visited by a severe hailstorm which, it is said here, has never been equalled at Malta.

The stones were indeed of an abnormal size, in many cases larger than a good-sized duck egg, and in some places larger than an orange, several of half a pound were weighed, three in a pound were numerous, and they came down with terrific force, smashing glass and everything breakable right and left, amidst deafening noise. Such a heavy downfall is unprecedented, and the oldest inhabitant can not remember the like of it. Fortunately, the cloud-burst did not last long, otherwise there would have been the danger of roofs giving way under the weight of the ice, which would have accumulated on the terraces.

The storm came indeed as a surprise. A sultry southwest wind had been blowing for some days, and in the morning a breeze from the northwest set in. The weather was fine until about 1 p. m., when banks of clouds appeared in the northwest. But no signs were visible of what was impending. The wind suddenly rose, and shortly after, the storm broke out like a thunderbolt from the blue, just as did the tornado of the 1st instant.

Hail falls nearly every season in Malta, but its size is very diminutive, seldom being greater that one-fourth of an inch in diameter, at times it is a little larger, but the hailstone is practically unknown.

All during this week the *sirocco* has been blowing with an amazing perseverance, but the day before yesterday at 1:20 p. m. the premonitory signs of a storm were seen on the western horizon. Dark, low, heavy clouds began to gather little by little, distant thunder was heard and lightning seen in the skies; these were soon covered over by dark clouds; at 1:45 the *irpar*, as it is called in Maltese, was in full action. The wind veered to the west, it kept on rising higher, clouds of dust were driven before it, and at 2 p. m. the storm was at its maximum. All this time, a distant rumbling noise was heard, everybody was wondering what was the cause of it, but its explanation was soon forthcoming. Hail began to fall and kept coming down for over five minutes.

[NOTE.—We perceive that the local English newspapers as well as the manuscript of our consul speak of the storm of October 1 as a cyclone, a gale, a cloud-burst, a tornado, whereas the storm of the 19th was simply a hailstorm or the Maltese *irpar*. It is not certain that the popular nomenclature in Malta and England is any better than that in the United States.—ED.]

## THE AVERAGE FREQUENCY OF DAYS OF HAIL DURING 1893–1897.

By Miss ALICIA DE RIEMER and C. ABBE.

The records published regularly in the MONTHLY WEATHER REVIEW show the number of days in each month on which hail fell at one or more stations in each State. Thus, in Alabama it fell on six days in April, 1893; twice in April, 1894, and three times in April, 1895, 1896, and 1897, respectively, or on the average 3.4 days annually. The following lines give a summary of this published data for the five years. 1893–1897. The relative frequency of hailstorms must be computed from this data by different methods according as we desire to ascertain the relative frequency per month in any one State, or the relative frequency during any month in the different States.

TABLE 1.—*Total absolute frequency of hailstorms during* 1893–1897.

| States. | Areas in units of 10,000 square miles. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. State. | Annual. Unit area. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 5.1 | 6 | 6 | 17 | 17 | 16 | 13 | 4 | 7 | 4 | 1 | 3 | 4 | 98 | 19.3 |
| Arizona | 11.4 | 5 | 9 | 9 | 8 | 7 | 6 | 13 | 19 | 16 | 15 | 4 | 2 | 113 | 9.9 |
| Arkansas | 5.2 | 4 | 12 | 19 | 37 | 16 | 16 | 6 | 8 | 4 | 4 | 4 | 2 | 132 | 25.4 |
| California | 15.8 | 22 | 19 | 45 | 36 | 21 | 4 | 8 | 5 | 8 | 9 | 10 | 14 | 201 | 12.7 |
| Colorado | 10.4 | 0 | 1 | 11 | 18 | 41 | 69 | 60 | 63 | 24 | 19 | 1 | 0 | 307 | 29.6 |
| Connecticut | 0.5 | 0 | 3 | 3 | 12 | 1 | 12 | 11 | 6 | 4 | 0 | 2 | 0 | 54 | 108. |
| Delaware | 0.2 | 0 | 0 | 2 | 3 | 5 | 2 | 2 | 2 | 1 | 0 | 1 | 1 | 19 | 95. |
| Dist. of Columbia. | 0.01 | 0 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 700. |
| Florida | 5.9 | 3 | 8 | 5 | 13 | 18 | 7 | 3 | 2 | 1 | 0 | 0 | 0 | 60 | 10.5 |
| Georgia | 5.8 | 2 | 4 | 13 | 21 | 22 | 13 | 10 | 4 | 2 | 2 | 2 | 3 | 98 | 16.9 |
| Idaho | 8.1 | 0 | 1 | 8 | 38 | 42 | 34 | 13 | 14 | 12 | 9 | 1 | 0 | 172 | 21.3 |
| Illinois | 5.5 | 2 | 3 | 22 | 47 | 39 | 41 | 25 | 18 | 21 | 11 | 1 | 2 | 232 | 42.2 |
| Indiana | 3.4 | 1 | 1 | 18 | 34 | 40 | 29 | 18 | 15 | 7 | 1 | 2 | 1 | 167 | 49.2 |
| Indian Territory. | 3.1 | 1 | 3 | 12 | 10 | 5 | 1 | 0 | 0 | 1 | 2 | 4 | 0 | 39 | 12.9 |
| Iowa | 5.5 | 2 | 0 | 15 | 42 | 43 | 42 | 34 | 27 | 17 | 6 | 3 | 1 | 232 | 42.2 |
| Kansas | 8.1 | 1 | 3 | 19 | 57 | 51 | 61 | 22 | 9 | 20 | 9 | 1 | 1 | 254 | 31.4 |
| Kentucky | 3.8 | 1 | 4 | 14 | 25 | 23 | 21 | 19 | 22 | 3 | 4 | 0 | 0 | 136 | 35.8 |
| Louisiana | 4.1 | 5 | 14 | 21 | 19 | 14 | 7 | 6 | 2 | 0 | 5 | 7 | 3 | 103 | 25.2 |
| Maine | 3.5 | 0 | 0 | 1 | 1 | 7 | 8 | 4 | 2 | 4 | 5 | 0 | 0 | 32 | 9.2 |
| Maryland | 1.1 | 1 | 0 | 5 | 8 | 17 | 12 | 23 | 16 | 6 | 5 | 4 | 0 | 97 | 88.2 |
| Massachusetts | 0.8 | 0 | 0 | 3 | 14 | 16 | 13 | 20 | 13 | 6 | 5 | 1 | 0 | 81 | 102. |
| Michigan | 5.6 | 1 | 0 | 10 | 20 | 38 | 26 | 12 | 27 | 13 | 11 | 0 | 0 | 158 | 28.3 |
| Minnesota | 8.4 | 0 | 0 | 5 | 29 | 34 | 46 | 27 | 35 | 10 | 2 | 0 | 0 | 188 | 22.4 |
| Mississippi | 4.7 | 4 | 13 | 28 | 22 | 16 | 12 | 3 | 2 | 1 | 1 | 2 | 4 | 108 | 23.1 |
| Missouri | 6.5 | 7 | 7 | 30 | 66 | 47 | 51 | 24 | 18 | 16 | 11 | 4 | 4 | 285 | 43.9 |
| Montana | 14.4 | 0 | 0 | 2 | 8 | 23 | 35 | 29 | 17 | 8 | 6 | 0 | 0 | 128 | 8.9 |
| Nebraska | 7.6 | 0 | 0 | 9 | 46 | 33 | 55 | 31 | 29 | 10 | 0 | 3 | 3 | 219 | 28.9 |
| Nevada | 11.2 | 2 | 0 | 8 | 21 | 26 | 20 | 21 | 12 | 14 | 15 | 7 | 0 | 146 | 13.1 |
| New Hampshire | 0.9 | 0 | 0 | 1 | 5 | 6 | 12 | 9 | 5 | 3 | 6 | 1 | 0 | 48 | 53.4 |
| New Jersey | 0.8 | 0 | 0 | 5 | 9 | 12 | 16 | 14 | 12 | 10 | 3 | 8 | 0 | 89 | 112. |
| New Mexico | 12.1 | 1 | 2 | 5 | 4 | 19 | 31 | 17 | 20 | 8 | 8 | 3 | 2 | 120 | 9.9 |
| New York | 4.7 | 0 | 0 | 8 | 26 | 17 | 23 | 22 | 20 | 16 | 13 | 3 | 0 | 148 | 31.5 |
| North Carolina | 5.1 | 2 | 4 | 11 | 18 | 36 | 26 | 16 | 8 | 6 | 3 | 1 | 2 | 133 | 26.1 |
| North Dakota | 7.5 | 0 | 0 | 1 | 17 | 31 | 28 | 26 | 21 | 14 | 4 | 1 | 0 | 143 | 19.1 |
| Ohio | 4.0 | 0 | 1 | 16 | 41 | 45 | 36 | 25 | 21 | 12 | 14 | 3 | 1 | 215 | 53.7 |
| Oklahoma | 3.9 | 0 | 3 | 3 | 28 | 19 | 10 | 3 | 1 | 2 | 2 | 2 | 0 | 73 | 18.7 |
| Oregon | 9.5 | 7 | 21 | 33 | 33 | 35 | 19 | 10 | 4 | 12 | 6 | 14 | 10 | 204 | 21.5 |
| Pennsylvania | 4.6 | 0 | 1 | 5 | 19 | 27 | 22 | 27 | 20 | 11 | 5 | 4 | 1 | 142 | 30.9 |
| Rhode Island | 0.1 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 1 | 2 | 0 | 1 | 1 | 10 | 100. |
| South Carolina | 3.4 | 4 | 9 | 3 | 13 | 20 | 21 | 3 | 16 | 0 | 4 | 1 | 3 | 97 | 28.6 |
| South Dakota | 7.6 | 0 | 0 | 4 | 20 | 18 | 46 | 39 | 17 | 7 | 2 | 1 | 0 | 154 | 20.3 |
| Tennessee | 4.6 | 2 | 3 | 25 | 30 | 22 | 18 | 11 | 8 | 6 | 2 | 3 | 2 | 131 | 28.5 |
| Texas | 27.4 | 8 | 10 | 34 | 45 | 37 | 22 | 8 | 8 | 5 | 7 | 8 | 6 | 198 | 7.2 |
| Utah | 8.4 | 1 | 3 | 5 | 18 | 21 | 22 | 18 | 15 | 12 | 11 | 1 | 1 | 128 | 15.3 |
| Vermont | 1.0 | 0 | 0 | 1 | 5 | 3 | 7 | 4 | 9 | 2 | 1 | 0 | 0 | 32 | 32. |
| Virginia | 6.1 | 1 | 2 | 7 | 15 | 29 | 16 | 14 | 10 | 5 | 1 | 2 | 0 | 102 | 16.8 |
| Washington | 7.0 | 1 | 12 | 32 | 47 | 22 | 11 | 2 | 2 | 13 | 17 | 8 | 7 | 174 | 24.8 |
| West Virginia | 2.3 | 0 | 1 | 4 | 21 | 22 | 15 | 9 | 4 | 4 | 7 | 3 | 1 | 91 | 39.7 |
| Wisconsin | 5.8 | 0 | 2 | 7 | 37 | 40 | 33 | 21 | 16 | 12 | 7 | 1 | 0 | 166 | 31.4 |
| Wyoming | 9.8 | 0 | 0 | 1 | 9 | 3 | 18 | 12 | 9 | 4 | 0 | 0 | 0 | 56 | 5.8 |

In the latter case, we must divide the monthly averages by the area of the State in order to eliminate the inequality depending on the size of the State. Table 1 shows, 1st, the area of each State, expressed in units of 10,000 square miles; 2d, the total number of dates on which hail fell during the five years, both for each month and for the year. Finally, in the last column, the proportionate total number of hail days for one unit of area. The States in which hail-falls per unit area have been most frequent are the small States, viz, Connecticut, 108; District of Columbia, 700; Maryland, 88; Massachusetts, 102; New Hampshire, 53; New Jersey, 112; Ohio, 54; Rhode Island, 100. But these large numbers result from the smallness of the divisors, and omitting these States from consideration, we find the greatest frequency of hail in